Interactive Comparative Analysis

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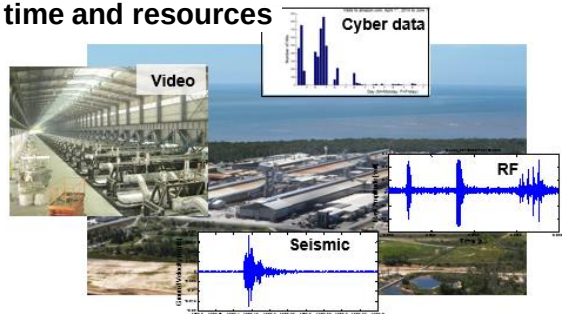
Interactive Comparative Analysis

Tools for Multi-Sensor, Multi-Modal Data Fusion and Signature Discovery

BACKGROUND & MOTIVATION

Manual synthesis of information from multiple sensors can overwhelm analyst time and resources

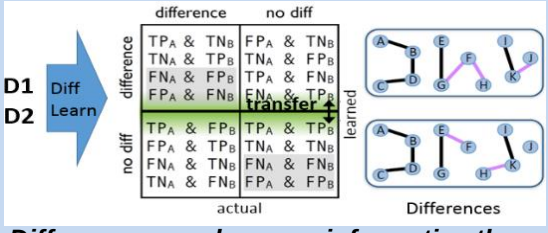


Structure learning tools identify correlations in data and can help identify new multi-sensor signatures, but are sensitive to noise and are not optimized for comparative analysis.

INNOVATION

We can learn the correlations between sensors and modalities that differentiate activities (or operating modes) by using transfer learning.

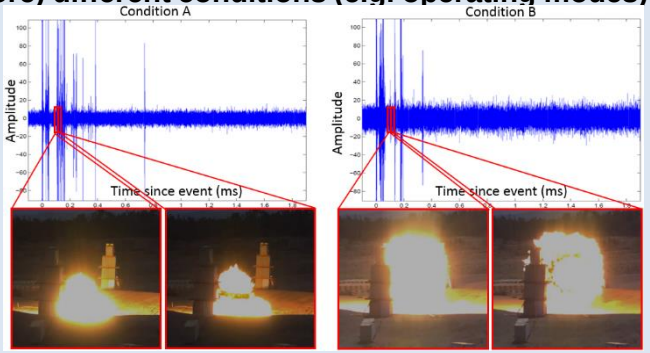
- The typical approach learns solutions independently and then compares the results.
- Our tool learns differences directly and provides users with greater control over the detection and false alarm rates.



Differences can be more informative than explanations.

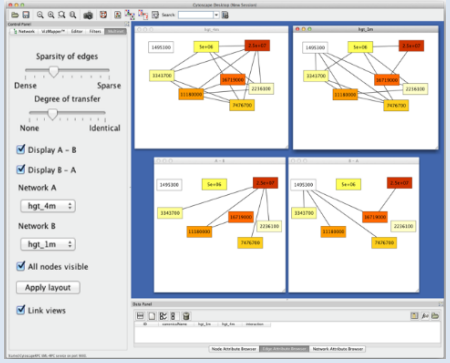
DESCRIPTION

Comparative analysis takes two sets of multi-sensor, multi-modal data collected under two (or more) different conditions (e.g. operating modes).



Broad band time series and high frame rate video are co-collected under two experimental conditions (A and B).

Interactive tool enables users to focus on the correlations that differentiate the two experimental conditions.



Prototype tool shows correlations that are specific to each experimental condition (right-top) and the correlations that differentiate the two datasets (right-bottom). Simple and intuitive threshold sliders enable users to control the tradeoff between the number of correlations and the detection and false alarm rates.

Current Technology Readiness Level (TRL) 3

- Our research prototype has been used in bio-informatics applications and in multi-sensor data fusion experiments.

ANTICIPATED IMPACT

Our new approach to data fusion and signature discovery has a number of advantages and applications:

- Finding correlations that differentiate datasets requires less data than finding correlations that explain datasets.
- The differences between datasets are smaller in number, and often easier to understand than the datasets themselves.
- By comparing datasets with different sensors and data types, our tools can help evaluate (and validate) tradeoffs in multi-sensor data collection systems.

PATH FORWARD

Current Phase – LDRD:

- Develop theory and algorithms for interactive comparative analysis and demonstrate anticipated impact.

Phase 2 – Application Development:

- Identify multi-sensor, multi-modal data experiments and work with end-users to tailor and evaluate approach on their specific problems.

Phase 3 – Signature Discovery:

- Work with end-users in particular domains to inform multi-sensor data collection experiments and systems.

Potential End Users: Analysts with multi-sensor data that lack time and resources to explore cross-sensor correlations.

Point of Contact: Reid Porter, ISR Division, 665-7508, rporter@lanl.gov